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What Happens to the Scores? The Effects of Learning Management Systems Use on Students' Course Evaluations

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Abstract: Learning Management Systems (LMS) are web-based systems that allow instructors and/or students to share materials, submit and return assignments, and communicate online. In this study, we explored the possible effects of LMS use on students' assessments of courses, instructor effectiveness, and their own learning. We examined the relationship between instructors' LMS use over two academic terms and three items from students' course evaluations, and used the results from a user survey to inform our understanding of the relationship between course ratings and LMS use. Findings suggest that students do not rate courses more highly when instructors use LMSs. However, survey data shows that students value LMSs but perhaps for reasons different from instructors'. As instructors gain experience with tools within LMSs that foster interaction outside the classroom, their use of these systems may lead to improvements in course evaluation scores.

Technology-enabled learning is increasingly important and pervasive in higher education. Course Management Systems (CMS) or Learning Management Systems (LMS) are web-based systems that allow instructors and/or students to share instructional materials, make class announcements, submit and return course assignments, and communicate with each other online. A recent report showed that over 90% of all universities and colleges have established one or more LMS-type products for student and faculty use (Hawkins, Rudy, & Nicolich, 2005). While the adoption rate for these systems has been very rapid, little is known about when and how these systems benefit learning (Koszalka & Ganesan, 2004).

The goal of this study was to explore the effects of using a LMS on students' ratings of courses, instructors, and their own learning. Specifically, we examined instructors' use of the LMS over two academic terms and analyzed three standard items from students' course evaluations submitted at the end of each term. Results from a user survey¹ administered to instructors and students were used to inform our understanding of the relationship between course ratings and LMS use.

Theoretical Framework

New technologies, such as LMS, provide opportunities to change existing teaching practices and have the potential to make teaching more efficient. However, a LMS can also provide functionality beyond making standard course content easily available online. Specifically, new technologies can facilitate a shift from "the transmission of information towards the management and facilitation of student learning," adhering to constructivist tenants of instruction (Coaldrake & Stedman, 1999, p. 7). Whether instructors use new technologies and

¹ The survey instrument is available upon request.

how effectively they use them for improving student learning outcomes are becoming two main standards for judging instructional competency (McInnis, 2002). However, faculty are often reluctant to revise and restructure their courses in light of new technologies because they are skeptical that their time and effort will be rewarded, and there is little pedagogical guidance for integrating these technologies into everyday instruction (Bass, 2000).

Although there is little data on the learning outcomes of using LMS, several studies have investigated instructors' attitudes and use of LMS and other similar systems. Bennett and Bennett (2003) administered surveys to 20 instructors before and after a Blackboard (<http://www.blackboard.com>) training program and found that training improved the likelihood of instructor adoption. Morgan (2003) surveyed 740 faculty and instructional staff from all 15 University of Wisconsin system institutions. She found that instructors adopt LMSs principally to manage administrative and relatively mundane tasks associated with teaching, particularly in large lecture courses, and faculty used the system to achieve a number of teaching goals that included supplementing lecture materials, increasing transparency and feedback, and increasing contact with and among students. West, Waddoups, and Graham (2007) conducted interviews and surveys about how instructors at Brigham Young University implemented Blackboard into their instruction. Using Rogers' (2003) model for understanding the adoption decision process, they found that instructors grappled with several small decisions as they weighed the advantages and disadvantages in each stage of LMS adoption. The stages in Rogers' model include: Knowledge (learning about the innovation), Persuasion (mental decision about the innovation), Decision, Implementation, and Confirmation (reinforcement or discontinuation).

Early adopters of LMSs in higher education have typically come to these applications because they promise to make teaching more efficient. LMSs are also being adopted because they are a symbol of innovation and thus create a competitive advantage in the education marketplace and provide opportunities for enabling institutional innovations in learning and education (Dutton, Cheong, & Park, 2003). Although most LMSs are used for the distribution, management, and retrieval of course materials, these systems are increasingly incorporating functionality that supports communication between students and instructors and among students (West et al, 2007). Communication tools within LMSs provide the kinds of active online engagement preferred by today's generation of students (e.g., discussion tools, chat rooms, wikis, and blogs) and provide opportunities for using these systems according to constructivist approaches to learning rather than simple transmission of knowledge models. In a recent study of WebCT and Blackboard use conducted at Williams, Brandeis, and Wesleyan, more students than faculty reported that the use of these systems "improved learning" (Hanson & Robson, 2004).

In this study, we explored the possible effects of using a LMS on students' assessments of courses, instructor effectiveness, and their own learning. Previous research has explored other factors related to student ratings such as an instructors' knowledge of the subject, enthusiasm for teaching, and ability to tie information together (Broder & Dorfman, 1994); students' grades (Feldman, 1976; Powell, 1977); class size, course level, "electivity" of the course, subject matter, and time of day (Feldman, 1978). How LMS use impacts student ratings is as yet unexplored. Previous studies of course evaluations have shown that student ratings are influenced by a large number of variables, including instructors' behavior and attitudes toward students and their learning. The effects of each of those variables is often small to moderate but when combined can explain a large proportion of the variance in evaluation scores (Feldman, 1978). By analyzing students' evaluations as well as their responses on an annual user survey, we hope to

demonstrate that as technology continues to transform the ways that students are educated, LMS usage has an impact on students' perceptions of teacher effectiveness and students' learning.

Method

Data Sources

Our study used publicly available course evaluation data from undergraduate and graduate courses taught at a large midwestern research university during two winter semesters (2005 & 2006). In these course evaluations, students are asked to respond to items on a 5-point Likert scale ranging from 1 = "I strongly disagree" to 5 = "I strongly agree." The three evaluation items used in this study are:

1. Overall, this was an excellent course.
2. Overall, the instructor was an excellent teacher.
3. I learned a great deal in this course.

In order to limit possible effects due to variation between instructors, the evaluation data was matched across the two years so that only ratings for the same instructor teaching the same course were examined. Thus, the final dataset represented two ratings for 493 courses from over 70 different departments and disciplines within the university. Courses were also coded for "level" (e.g. 100-level, 200-level, etc.). The distribution by level was: 9% 100-level, 10% 200-level, 15% 300-level, 20% 400-level, and 47% graduate-level. Class sizes for these courses ranged from 1 to 557 students with a mean of 30.43 students per course.

The second dataset used for this study was a user survey, administered in April 2006, as part of an annual evaluation process for the LMS. Surveys have been found to be useful for gathering information about ephemeral features of LMS users and their use of the available tools (Malikowski, Thompson, & Theis, 2007). All instructional faculty and a sample of 25% of university students, stratified by school/college, were invited to participate in this survey. Our response rate was 19% for instructors (n=1,357) and 27% for students (n=2,485).

Design & Procedure

The LMS examined in this study is based on the Sakai (<http://sakaiproject.org>) community-source architecture. This environment is comparable to other popular systems such as Blackboard, WebCT (<http://www.webct.com>), and Moodle (<http://moodle.org>).

The course evaluation dataset included the term, course size and an additional course evaluation item that indicated a student's desire to take the course. We coded the course evaluation data by term and whether or not the course employed the LMS. Additionally, LMS usage was coded into three categories depending on the type of tools used on course sites (see "Phase Two" below). We examined the tools used by the instructors from the first term to the second in a separate statistical analysis. Finally, the course evaluation dataset findings were compared to the findings from the user survey.

Results

Our analysis of LMS usage and course evaluation scores included several phases. The first phase compared ratings for courses that used the LMS and courses that did not. The second phase examined that types of tools used within the LMS and investigated if course evaluation scores were affected by the kinds if tools used within the LMS. A third phase investigated changes in the ways instructors used the LMS from year to year and how those changes may have affected the course evaluation scores. The final phase of analysis examined several possible predictors of students' course ratings and whether the relationship between LMS usage and evaluation scores was affected by these other factors.

Phase One – LMS Usage vs. No LMS Usage

The first phase of our analysis compared courses that used the LMS and courses that did not use the LMS (see Table 1). For the first evaluation question, "Overall, this was an excellent course," the mean difference in LMS usage (0.07) was significant for this question ($t(936) = 2.03, p = .04$), where courses taught without the LMS were rated more highly than courses taught with the LMS.

For the second evaluation question, "Overall, the instructor was an excellent teacher," the mean difference in LMS usage (0.05) followed the same pattern as the previous question, but was not statistically significant.

The third evaluation question, "I learned a great deal in this course," followed the same pattern as the previous questions, where the mean difference in LMS usage (0.02) was also not statistically significant.

Table 1: Overall Course Ratings and Mean Differences for LMS Usage versus No LMS Usage

Item	No LMS	Yes LMS	Mean Difference
Excellent Course	4.36 (n=449)	4.29 (n=489)	.07**
Excellent Teacher	4.47 (n=468)	4.41 (n=504)	.06
Learned a Great Deal	4.40 (n=453)	4.38 (n=485)	.02

Note: ** $p < .05$

Phase Two – LMS Tool Usage

The second phase of our analysis examined the types of tools used on the course sites to characterize the degree to which the sites were used to increase interaction between the instructor and the students (see Table 2). We examined three types of LMS tools used: course material sharing only ("Mainly Resources"), resources and the online assignments tool ("Resources + Assignments"), and resources and the chat and/or threaded discussion tools ("Resources + Chat / Discussion"). Course sites with fewer than 10 separate resource, assignments, discussion, or chat user events (e.g. a student submitting an assignment is 1 event) were not included in the resources, assignments, or chat/discussion categories. We used the ratings for courses that did

not use the LMS as a baseline measure of comparison. ANOVAs revealed that the types of LMS tools significantly influenced ratings on all three evaluation questions at a $p < 0.05$. The direction and magnitude of the effects differed on each question.

For the first evaluation question, "Overall, this was an excellent course," there were significant differences among the evaluation scores over the four categories of LMS tool usage ($F(3, 934) = 4.13, p = .006$). Courses with "No LMS" were rated highest and courses with "Resources + Assignments" were rated lowest. Courses with "Mainly Resources" and "Resources + Chat/Discussion" showed ratings in between the other category types.

For the second evaluation question, "Overall, the instructor was an excellent teacher," there were similar significant effects for tools used; courses with "No LMS" were rated highest and courses with "Resources + Assignments" were rated lowest ($F(3, 968) = 2.78, p = .04$). Again, "Mainly Resources" and "Resources + Chat/Discussion" showed ratings that fell in between the other category types.

For the third evaluation question, "I learned a great deal in this course," statistically significant differences among the categories were again present. This question showed a slightly different pattern for scores; ratings for courses with "No LMS" and "Resources + Chat / Discussion" were rated equally highly, followed by "Mainly Resources" and then "Resources + Assignments" ($F(3, 934) = 2.60, p = .05$).

Table 2: Mean Course Ratings by Tools Used

Item	N	No LMS	Mainly Resources	Resources + Assignments	Resources + Chat / Discussion
Excellent Course	938	4.36 (n=449)	4.32 (n=396)	4.04 (n=30)	4.28 (n=63)
Excellent Teacher	972	4.47 (n=468)	4.43 (n=413)	4.20 (n=30)	4.40 (n=61)
Learned a Great Deal	938	4.40 (n=453)	4.39 (n=396)	4.17 (n=30)	4.40 (n=59)

Phase Three – LMS Tool Usage Patterns From Year to Year

The third phase of our analysis was an examination of changes in tool use across two terms using the categories described earlier, creating 16 possible combinations, eight of which are presented in this paper (see Tables 3 and 4). Combinations represented by less than 10 courses were excluded from analysis. While differences between these usage patterns were not statistically significant, effect size analysis shows that some of the differences did have small to medium effects. The trends shown in Tables 3 and 4 suggest an explanation for some of the variation seen above in our earlier analyses.

Table 3 shows the differences in course ratings for instructors who changed from not using the LMS in one term to using the LMS with various combinations of tools enabled in the subsequent term. Enabling various combinations of tools produced mixed results in course evaluation scores. Instructors who changed from not using the LMS to using the LMS for "Mainly Resources" did not see a statistically significant change in any of their evaluation scores; however, courses that changed from no LMS to "Resources + Assignments" received a

small positive effect for “Excellent Course” and a medium positive effect for “Learned a Great Deal.” However, when instructors changed from not using the LMS to using the LMS with the highly interactive tools including chat or threaded discussion, they received effectively lower ratings for two questions: Excellent Course and Excellent Instructor. In Table 3, a negative mean difference indicates instances where ratings decreased when instructors moved from no LMS to a given combination of interactive tools.

Table 3: Means for Course Ratings When Instructors Changed from No LMS to LMS Usage

Item	Usage Pattern: 2005 → 2006			
	No LMS → No LMS	No LMS → Mainly Resources	No LMS → Resources + Assignments	No LMS → Resources + Chat / Discussion
Excellent Course	4.35 → 4.38 (Difference = .03) (n=170)	4.39 → 4.41 (Difference = .02) (n=66)	3.77 → 3.97 (Difference = .20*) (n=10)	4.50 → 4.24 (Difference = -.26**) (n=10)
Excellent Teacher	4.46 → 4.49 (Difference = .03) (n=169)	4.44 → 4.46 (Difference = .02) (n=86)	4.02 → 4.04 (Difference = .02) (n=10)	4.56 → 4.41 (Difference = -.15*) (n=10)
Learned a Great Deal	4.40 → 4.40 (Difference = .00) (n=167)	4.43 → 4.42 (Difference = -.01) (n=75)	3.94 → 4.21 (Difference = .27**) (n=10)	4.52 → 4.55 (Difference = .03) (n=10)

Note: * small effect size (Cohen's *d* greater than .15 and less than .40), ** medium effect size (Cohen's *d* greater than .40 and less than .75)

Table 4 shows the differences in course ratings for instructors who changed from using the LMS with various tools enabled in one term to keeping those tools, changing those tools, or not using the LMS at all in the subsequent term. Using resources alone from one term to the next does not significantly affect any of the evaluation scores. However, using a LMS for resources one term and then not using it at all the second term does appear to have a small negative effect on all evaluation scores. The repeated use of highly interactive tools such as chat and discussion threads leads to a higher evaluation scores for two evaluation items: Excellent Course and Excellent Teacher.

Table 4: Means for Course Ratings When Instructors Changed LMS Usage

Item	Usage Pattern: 2005 → 2006			
	Mainly Resources → Mainly Resources	Mainly Resources → No LMS	Mainly Resources → Chat / Discussion	Chat / Discussion → Chat / Discussion
Excellent Course	4.27 → 4.28 (Difference = .01) (n=138)	4.49 → 4.39 (Difference = -.10*) (n=22)	4.30 → 4.32 (Difference = .02) (n=17)	4.22 → 4.25 (Difference = .03) (n=14)
Excellent Teacher	4.41 → 4.38 (Difference = -.03) (n=137)	4.62 → 4.53 (Difference = -.09*) (n=22)	4.41 → 4.48 (Difference = .07) (n=14)	4.25 → 4.32 (Difference = .07) (n=14)
Learned a Great Deal	4.39 → 4.36 (Difference = -.03) (n=133)	4.53 → 4.42 (Difference = -.11*) (n=21)	4.40 → 4.38 (Difference = -.02) (n=14)	4.35 → 4.31 (Difference = -.04) (n=14)

Note: * small effect size (Cohen's *d* greater than .15 and less than .40)

Phase Four – Other Evaluation Score Predictors

Because prior research on course evaluations has found that a variety of factors can account for students' course evaluation scores (e.g. Broder, 1994; Feldman, 1978; Marsh, 1987), we included these in our models for the fourth phase of the analysis. Specifically, Feldman (1978) reviewed available literature on the characteristics of courses and instructors that influence students' ratings and found that associations between one or more characteristics are often small but when combined, may explain more variance. Thus, our final phase of analysis sought to determine how much of the course evaluation score was predicted specifically by LMS usage when these additional factors are also considered. The additional factors examined in this analysis were: course size (number of students in the course), course level (100-level, 200-level, etc.), and students' desire to take the course.

First, we ran correlations for each of the three evaluation questions and the factors listed above (see Table 5). The factor with the strongest correlations with the evaluation questions was the student's desire to take the course. As a student's desire increases, the evaluation scores increase. A similar pattern was seen with course level, although the effect was not as strong and was only significant for "Excellent Course." Conversely, as the size of a course increases, the evaluation scores decrease, showing that smaller classes receive higher student ratings. Our results for course level and course size findings are consistent with previous research (Wachtel, 1998). Consistent with our results in Phase 1 of this study, LMS usage was negatively correlated with increases in evaluation scores.

Table 5: Correlations for Evaluation Scores by Predictor Factors

Item	Course Size	Course Level	Desire to Take Course	LMS Usage
Excellent Course	-.207* (n=938)	.079** (n=938)	.702* (n=916)	-.066** (n=938)
Excellent Teacher	-.135* (n=972)	.007 (n=972)	.571* (n=916)	-.055 (n=972)
Learned a Great Deal	-.133* (n=938)	.023 (n=938)	.642* (n=916)	-.022 (n=938)

Note: * $p < .01$, ** $p < .05$

Next, the four factors were analyzed using regression models (see Tables 6-8). Since the correlations indicated that a students' desire to take the course was the strongest predictor of course ratings, we evaluated this factor first for each evaluation question (Model 1). For all three evaluation questions, the regression analysis confirmed that desire to take the course was the strongest predictor. Prior research has also found that students with greater interest in a course's subject area tend to rate the instructor more favorably (Feldman, 1977; Marsh & Cooper, 1981; Prave & Baril, 1993). Course size was also a significant predictor of the "Excellent Course" rating and course level was a significant predictor of the ratings for "Excellent Teacher" and "I Learned a Great Deal" ratings (Model 2). LMS usage was not a strong predictor of course evaluation scores for any of the evaluation questions. The incremental change in adjusted R^2 from Model 1 to 2 was not significant for any of the evaluation questions.

Table 6: Regression Models for "Overall, this was an excellent course"

Parameters	Model 1 (N = 916)		Model 2 (N = 916)	
	β	p	β	p
Intercept	1.634	.000	1.736	.000
Desire to Take Course	.702	.000	.694	.000
Course Size			-.056	.027
Course Level			-.037	.140
LMS Usage			.000	.991
Adjusted R ²	.492		.494	

Table 7: Regression Models for "Overall, the instructor was an excellent teacher"

Parameters	Model 1 (N = 916)		Model 2 (N = 916)	
	β	p	β	p
Intercept	2.305	.000	2.422	.000
Desire to Take Course	.571	.000	.572	.000
Course Size			-.036	.216
Course Level			-.073	.011
LMS Usage			-.008	.760
Adjusted R ²	.326		.329	

Table 8: Regression Models for "I learned a great deal in this course"

Parameters	Model 1 (N = 916)		Model 2 (N = 916)	
	β	p	β	p
Intercept	2.282	.000	2.316	.000
Desire to Take Course	.642	.000	.651	.000
Course Size			-.006	.816
Course Level			-.062	.021
LMS Usage			.030	.233
Adj. R ²	.411		.413	

The outcomes of our regression analyses were consistent with prior research showing that course size, course level, and desire to take a course are significant predictors of course evaluation scores. When LMS usage is included in a regression model with these factors, LMS usage does not appear to be a predictor of evaluation scores. However, the analyses completed in the first three phases of our study illustrate that evaluation scores are sensitive to the ways in which faculty use the tools offered within these system and their experience with the tools from term to term.

User Survey Results: What faculty and students say about LMS Usage

A user survey was administered to instructors and students in April 2006 as part of the annual evaluation of the LMS. The response rate was 19% for instructors (n=1,357) and 27% for students (n=2,485). Several of the items from this survey provide insight into the results of the various analyses presented above.

Using a Likert scale from 1 ("Strongly Disagree") to 5 ("Strongly Agree"), Instructors and students were asked to respond to the statement "The use of information technology in courses has improved my own/my instructors' teaching." Students responded with a significantly lower score than ($t(3756) = 6.880, p < .001$). However, when asked to respond to a similar statement about student learning, "The use of information technology in courses has improved my own/my students' learning," there were no significant differences between instructor and student responses (see Table 9).

Table 9: Results of Survey Item about Information Technology's Effect on Teaching and Learning

Item	Instructors	Students	Mean Difference
IT Improves Teaching	3.90 (n=1301)	3.69 (n=2457)	.21*
IT Improves Learning	3.88 (n=1293)	3.90 (n=2449)	.02

Note: * $p < .01$

Instructors were also asked to report their *use* of information technology in courses using a range of five options including no use, limited use (e.g. email and limited PowerPoint), a moderate level of use (e.g. several PowerPoints and some online activities), extensive use (e.g. online lecture notes, streaming video, etc.), and exclusive use (entirely online courses). Students were also asked to report their *preference* for information technology in courses using these same options. Instructors and students responded quite differently on this item (see Table 10).

Table 10: Results of Survey Item about Use / Preference for Information Technology in Courses

	None	Limited	Moderate	Extensive	Exclusive
Instructors' Use	3% (n=36)	27% (n=365)	45% (n=615)	25% (n=335)	0% (n=3)
Students' Preference	2% (n=36)	15% (n=379)	39% (n=977)	43% (n=1061)	1% (n=29)

Instructors and students were asked to identify the "Most Valuable" benefit from using information technology in their courses (see Table 11). The most popular response from instructors (42%) was "Improved my communication to my students" while the most popular response from students (48%) was "Efficiency (saves time)." However, 26% of instructors did choose "Efficiency (saves time)" indicating that efficiency is important to both instructors and students. Overall, there was a significant difference in how instructors and students answered this question ($\chi^2(6, N=3560) = 360.42, p < .001$).

Table 11: Results of Survey Item about Most Valuable Benefit from Using Information Technology in Courses

	Improved my Teaching / Learning	Efficiency (Saves Time)	Helped Manage Course Activities	Improved Student to Instructor Communication	Improved Instructor to Student Communication	Improved Student to Student Communication	No Benefits
Instructors	11% (n=130)	26% (n=309)	11% (n=134)	5% (n=66)	42% (n=509)	3% (n=41)	2% (n=18)
Students	10% (n=236)	48% (n=1120)	18% (n=425)	5% (n=122)	15% (n=359)	3% (n=61)	1% (n=30)

We also asked instructors and students about specific uses of the LMS on a Likert scale from 1 ("Not Valuable") to 3 ("Very Valuable") (see Table 12). When asked about sending/receiving announcement messages from instructors to students, instructors rated this functionality significantly higher than students ($t(3078) = 8.624, p < .001$). Instructors also rated the ability for students to turn in assignments online and the ability for instructors to return assignments with grades ($t(2125) = 4.835, p < .001$) and comments significantly higher than students ($t(1358) = 5.133, p < .001$). However, over 80% of students did rate both assignment-related items as "Valuable" or "Very Valuable" indicating that most students view this type of functionality favorably. All three of these findings have small observed effects (see Table 12).

Table 12: How Valuable Are Different Uses of the LMS

Item	Instructors	Students	Mean Difference
Instructors send announcement messages to students	2.57 (n=940)	2.36 (n=2140)	.21*
Students turn in assignments online	2.33 (n=469)	2.17 (n=1658)	.17*
Instructors return assignments online	2.30 (n=469)	2.07 (n=1658)	.28*

Note: * $p < .01$

When we asked instructors and students to rate overall aspects of the LMS system using 5-point Likert scales, instructors ratings of the LMS were lower than students' ratings for a variety of questions (see Table 13). Overall, instructors found the LMS slightly less satisfying than students and significantly less easy ($t(3267) = 2.065, p = .039$). Instructors also reported that they thought the LMS was not as easy to learn how to use than students reported ($t(3195) = 6.897, p < .001$). Nor did instructors find that the time to learn the LMS was as fast as it was for students ($t(3186) = 7.943, p < .001$). Instructors also reported that tasks are not as often able to be performed in a straightforward manner as students reported ($t(3184) = 5.511, p < .001$).

Table 13: Overall Ratings of LMS Usability

Item	Instructors	Students	Mean Difference
Overall, the LMS is... 1 = Frustrating, 5 = Satisfying	3.76 (n=1061)	3.81 (n=2209)	.05
Overall, the LMS is... 1 = Difficult, 5 = Easy	3.83 (n=1058)	3.90 (n=2211)	.07**
Learning how to use the LMS 1 = Difficult, 5 = Easy	3.99 (n=1040)	4.22 (n=2157)	.23*
Time to learn the LMS 1 = Slow, 5 = Fast	3.85 (n=1038)	4.11 (n=2150)	.26*
Tasks can be performed in a straightforward manner 1 = Never, 5 = Always	3.49 (n=1036)	3.68 (n=2150)	.19*

Note: * $p < .01$, ** $p < .05$

In conjunction with the course evaluation scores, these survey results help illustrate how instructors and students view information technologies like the LMS and how they value these technologies in different ways. In the next section of this paper, we will evaluate what these findings mean for instructors and students and for continued LMS usage.

Discussion

In order to facilitate interpretation of the results described above, we examined data from course evaluation scores and our annual user survey together. First, the evaluation data showed a trend for students to rate courses using the LMS lower on all three evaluation items than for courses not using the LMS (see Table 1). In order to explain this difference, we investigated the survey items that asked respondents whether they believed information technologies improve teaching and learning (see Table 9). Students' responses regarding instruction indicates that many students feel that using technology like a LMS does not improve instructors' teaching, which may explain why students did not rate courses that used the LMS more highly on the "Excellent Course" and "Excellent Teacher" evaluation items. Also, since students responded slightly more favorably than instructors on the survey item about information technologies improving learning, their responses may explain why there is almost no difference between LMS usage categories on the "Learned a Great Deal" course evaluation question (see Table 2). Also, the trend observed in Table 4 for instructors who used the LMS in the first term and then did not use the LMS in the second term where students rated these courses lower in the second term would also seem to indicate that students do value this type of technology and could also partially explain the overall differences observed in Table 1.

Our second phases of analysis of the course evaluation scores demonstrated that while there are differences between evaluation categories when examining *whether* the LMS was used, it was much more important to consider *how* the LMS was used. When evaluation scores were examined holding course and instructor constant across two semesters, courses that used material sharing ("Resources") in conjunction with the assignments tool were rated significantly lower than other usage categories across all three evaluation items (see Table 2). This finding can be partially explained by students' ratings for turning in and receiving assignments online (see Table

12). While 64.4% of students reported that turning in assignments online was "Valuable" or "Very Valuable," only 38.5% of students found that receiving online assignment grades and feedback was "valuable" or "very valuable." If instructors were using the LMS assignments tool for both student submission and instructor return functions, students may not have viewed this type of interaction in a positive way. Furthermore, the qualitative answers from the survey indicate that both instructor and student users found the assignment tool difficult to use within the LMS. However, the few courses that had multi-year experience of using the assignments tool appear to show gains in student evaluation scores. This finding suggests that as instructors become more experienced in using and teaching with the tools, students rate their overall course experience more highly.

The idea of a "learning curve" for the LMS is further demonstrated by the LMS tool use patterns described in Phase 3 of our course evaluation analysis. Instructors who did not use the LMS in the first year and then used interactive tools such as chat and/or discussion in the next year saw a decrease in scores for the "Excellent Course" and "Excellent Teacher" categories (see Table 3). However, instructors who used these interactive tools for a second year saw modest increases in scores for these same categories (see Table 4). On their own, these results suggest that instructors may learn to use these interactive tools more effectively over time. Instructors at other institutions have also expressed difficulty understanding how to use interactive features so that student learning is maximized without requiring excessive amounts of instructor time (West et al, 2007). The usability questions from the survey (see Table 13) appear to support the presence of a slower learning curve for instructors versus students using the LMS. The survey results demonstrate that instructors report finding the LMS less satisfying, not as easy to use, not as fast to learn, and less often straightforward when trying to perform routine tasks than the students' report of their own experience. Thus, it can take a significant amount of time just to learn how to use the LMS and then additional time to learn how to teach with the tools in the LMS. This learning curve may also explain why instructors who use just resources one year and add interactive tools the next year have similar evaluation score gains as instructors who used the interactive tools in both years.

The differences in students' ratings of various types of instructors' use of the LMS may also be influenced by different expectations for this type of technology. When asked about the most valuable benefit of using technologies like a LMS for courses (see Table 11), 42% of instructors chose "Improved instructor to student communication." A majority of students (48%), however, chose "Efficiency (saves time)" as their top preference, but fewer instructors did so (26%). Given this mismatch of priorities, it is possible that when a student encounters a LMS site that does not match their expectations, course evaluation ratings are negatively affected. Since 43% of students reported that they prefer an "Extensive" amount of technology in their courses (see Table 10), improving evaluation scores may be a matter of matching instructor and student expectations with LMS use in courses.

The fourth phase of analysis demonstrated that the bulk of the variation in evaluation scores is based on a students' desire to take the course and, to a lesser extent, course size. While LMS use did demonstrate a significant negative correlation with "Excellent Course" evaluation scores, the use of the LMS was not a significant predictor in regression analyses. However, as previously described, the interesting variation in evaluation scores is not found in *whether* the LMS was used, but rather *how* the instructor used the available tools within the system affects how students rate their experiences in the course. As instructors become more familiar with the

LMS and as the tools mature and are improved, the different types of LMS usage may become a stronger predictor of course evaluation scores.

Future Research

We are planning to continue our research to further understand how instructors' course evaluation scores are affected by how instructors use the LMS. In our future research we hope to address some of the limitations of this study. First, the student course evaluation scores at the university are comprised of responses on 5-point Likert scales. Thus, the difference between an excellent rating and a very good rating then might be less than a tenth of point, particularly when examining averages of nearly 500 different courses. There simply is not enough variation within the scale provided to demonstrate clearly meaningful differences within the factors that we analyzed in this study.

A second limitation in this study was the small numbers of courses using the assignments and interactive tools (discussion and/or chat) within the LMS in comparison to the number of courses using only resources or not using the LMS. Some patterns of use (e.g. resources + assignments for two consecutive years) were not included in this student because they included fewer than 10 courses. Thus, a few courses that were rated poorly could drastically skew the data in these categories while larger categories (e.g. mainly resources) were more representative of the possible variation given the larger sample size. Several recent studies indicate that instructors use LMS tools to primarily transmit course materials to students (Ansorge & Bendus, 2003; Malikowski, Thompson, & Theis, 2006; Morgan, 2003). However, as instructors learn more about the LMS, many increase their tool use in subsequent terms (West et al, 2007). Thus, as more instructors learn how to use and teach with the LMS, the number of courses in these different categories may balance out in the future and provide a better picture of how different uses of the LMS affect course evaluation scores.

A few months before the start of the Winter 2006 term, one of the largest colleges at our university created a mandate requiring all instructors to, at a minimum, create a site on the LMS and upload an electronic version of their syllabus. Since this was the second year of our dataset in this study, a significant proportion of the roughly 100 courses that went from not using the LMS in 2005 to using the LMS in 2006 may have been mandated to do so and thus may not have approached their use of the LMS in an open-minded or willing manner. Additional analysis could mitigate any possible effect of this mandate on the analyzed evaluation scores and related LMS use.

Continued analysis will begin to establish how long-term use of LMS technologies impacts course evaluation scores. In addition to studying LMS use longitudinally, a qualitative analysis including interviews with instructors and a focused investigation of how instructors use the various tools within the LMS could provide a deeper understanding of how LMS systems are used by instructors, especially those who are considered by students to be particularly effective or innovative in integrating these tools into their pedagogy. Using a mixed-methods strategy of analysis could provide further evidence of how different forms of LMS use ultimately impact student learning and their evaluation scores.

Conclusion

Our analyses of course ratings demonstrate that students do not simply rate courses more highly because instructors use LMSs. However, user survey data suggests that students value LMSs but perhaps for different reasons than instructors. Of particular interest is the upward trend for overall course and instructor ratings for courses that use the LMS' interactive communication tools in consecutive years. As instructors gain experience with the tools that foster interaction outside the classroom, their teaching may ultimately be regarded more highly by students. Theall & Franklin (1990) note, "teaching is a multidimensional activity, and student ratings reflect the variety and range of teaching behaviors, as well as the successes and failures of those who practice its art, craft, and science" (p. 32). The challenge of using new technologies in the classroom lies in using them well. In future research, we hope to build on this study by looking more deeply at how instructors and students are using the LMS. In doing so, we can begin to generate more specific recommendations about practices that will help instructors and students use Learning Management Systems to maximize learning inside the classroom and out.

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